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Poly(ω-pentadecalactone)-b-poly(peptide) block copolymers for biomedical applications

Ernesto Tinajero-Díaz[1], **Antxon Martínez de Ilarduya**[1], **Andreas Heise**[2] and **Sebastián Muñoz-Guerra**[1]
[1]Universitat Politecnica de Catalunya, Spain
[2]Royal College of Surgeons in Ireland, Ireland

The presence of -COOH and -NH_2 side groups of glutamic acid and lysine in polyesters can help to improve their affinity for proteins and cells. Additionally, these side groups can be covalently or ionically combined with drugs, antibodies, or DNA's and thus may be exploited in the fields of targeting drug and gene delivery.

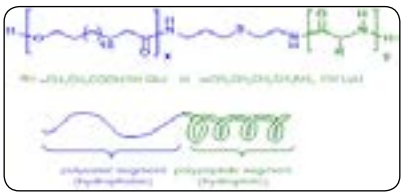

Figure 1. Block copolymers PPDL-b-PLGA and PPDL-b-PLLys synthesized in this work.

Poly(ω-pentadecalactone-b-γ-benzyl-L-glutamate) [PPDL-b-PBLG] and poly(ω-pentadecalactone-b-$^{\varepsilon}$N-carbobenzoxy-L-lysine) [PPDL-b-PZLLys] copolymers with different block lengths were synthesized through the ring-opening polymerization of γ-benzyl-L-glutamate and $^{\varepsilon}$N-carbobenzoxy-L-lysine NCA monomers using amino-ended PPDL as macroinitiator. The -COOH and -NH_2 side groups were recovered by hydrolysis in acidic medium. The macroinitiator PPDL-NH_2 was prepared by enzymatic ROP of pentadecalactone using allylamine as initiator followed by thiol-ene reaction with 2(Boc-amino)ethanethiol and final deprotection of the amino group with TFA.

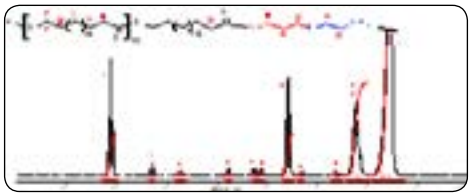

Figure 2. 1H-NMR (CDCl3) spectrum of the macroinitiator PPDL-NH_2 used for NCA polymerization.

The copolymerization reactions were carried out in solution and the chain length of the peptide block was controlled by adjustment of the ratio of the NCA monomer to macro-initiator. All copolymers were characterized by NMR, GPC and DSC techniques.

Recent Publications:

1. De Geus, M., Peters, R., Koning, C.E., Heise, (2008) Insights into the Initiation Process of Enzymatic Ring-Opening Polymerization from Monofunctional Alcohols Using Liquid Chromatography under Critical Conditions" Biomacromolecules, 9: 752-757.
2. Motala-Timol, S., Jhurry, D., Zhou, J., Bhaw-Luximon, A., Mohun, G., Ritter, H., (2008) Amphiphilic Poly(L-lysine-b-caprolactone) Block Copolymers: Synthesis, Charac-terization, and Solution Properties Macro-molecules, 41: 5571-5576.

Biography

E. Tinajero-Díaz started his Ph.D. thesis in 2015 with a grant awarded by CONACyT (México). He is currently interested in the synthesis of block and graft copolymers derived from macrolactones and poly(α-amino acid)s and their applications as potential materials in drug release.

ernesto.tinajero@upc.edu